



## Motion Tracking System

Industrial Productivity and Manufacturing Technology

**F**or future space operations, NASA is developing technology that would enable a robot resupply vehicle to automatically dock with and service Earth-orbiting satellites or the International Space Station.

As part of this program, NASA contracted with Integrated Sensors, Inc. (ISI), Utica, New York for development of a sensor system for controlling the robot vehicle during the critical docking phase. During this phase, the sensor and tracking system must sense the target satellite's relative motion and spin so that the robot vehicle can adjust its own motion to align with the satellite and slowly close until docking is accomplished.

ISI successfully developed the NASA system and then used the sensing/tracking technology as the basis of a commercial Object Position and Attitude Determination (OPAD) system that simultaneously tracks an object's linear and angular movement in all six degrees of freedom. Typical OPAD applications include analysis of human limb motion for physical therapy, assembly line position/motion analysis, video positioning of instruments and tools, auto crash dummy motion analysis, vehicle collision

avoidance, robot control, process control, precision machining and surgical probe tracking.

Shown **below**, OPAD consists of a camera, a processor, a decal set and an optional video display. The decal is attached to the object to be tracked and the camera is trained on it; OPAD then automatically follows the object as it moves and provides position/attitude measurements. The system uses off-the-shelf components that can be specially configured for a specific application.

ISI also used the NASA technology as the basis for a spinoff Motion Analysis Workstation, a software package intended to simplify the whole process of video motion analysis. In many applications, high speed cameras are used to record the motion of objects of interest on videotape and the tapes are then digitized for further analysis on a computer. The tracked points' motion is then converted to user-specific information, such as the force acting upon a dummy during an auto crash test. The latter step requires manual identification of the points of interest in each frame of video data. ISI's Motion Analysis software obviates that laborious and time-consuming task by performing it automatically and accurately.

